What is claimed is:

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1. A laser comprising:

a glass substrate doped with a laser species;

a waveguide defined within the substrate; and

a diode pump laser with an extended waveguide laser resonator cavity, the extended diode laser cavity being positioned adjacent the substrate waveguide so that pump light from the diode laser is absorbed along a length thereof.

2. The laser of claim 1 wherein the substrate is doped with Yb and Er.

3. The laser of claim 1 wherein the substrate is doped with Er.

4. The laser of claim 1 wherein the substrate waveguide forms a laser resonator cavity within the substrate.

5. The laser of claim 4 further comprising a reflection grating formed on the substrate surface along the substrate waveguide for providing feedback to the laser resonator cavity.

6. The laser of claim 5 further comprising:

a cladding deposited on the reflection grating of the substrate waveguide, the cladding being composed of an electro-optic polymer with a variable index of refraction; and

electrodes for applying an electrical potential across the grating cladding to vary the index of refraction in accordance therewith and thereby vary the wavelength of light reflected by the grating.

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7. The laser of claim 5 further comprising electrodes and a resistive element for heating and thermally expanding the reflection grating of the substrate waveguide to alter the wavelength reflected by the grating.

8. The laser of claim 5 further comprising electrodes for applying an electrical potential to a piezo-electric coating applied to the reflection grating to thereby vary the wavelength of light reflected by the grating.

9. The laser of claim 5 wherein the reflection grating is composed of an electro-optic polymer and further comprising electrodes for applying an electrical potential across the grating to vary the index of refraction in accordance therewith and thereby vary the wavelength of light reflected by the grating.

10. The laser of claim 5 further comprising:

one or more additional reflection gratings formed on the substrate waveguide, each grating having a cladding composed of an electro-optic polymer with a variable index of refraction deposited thereon; and

electrodes for selectively applying an electrical potential across each grating cladding to vary the index of refraction in accordance therewith and render the grating transparent or reflective at a wavelength corresponding to a longitudinal mode of the substrate waveguide laser cavity.

11. The laser of claim 4 further comprising a mirror coupled to a location along the substrate waveguide for providing feedback to the laser resonator cavity.

12. The laser of claim 1 wherein the extended waveguide cavity of the pump diode laser is a dielectric waveguide abutted at one end to an antireflection-coated gain section of the diode laser and at another end to a highly reflective mirror.

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13. The laser of claim 1 wherein the extended waveguide cavity of the pump diode laser is a dielectric waveguide abutted at one end to an antireflection coated gain section of the diode laser and at another end to a reflection grating.

14. The laser of claim 1 wherein the extended waveguide cavity of the pump diode laser has a lower index of refraction than the substrate waveguide and forms part of a cladding thereof.

15. The laser of claim 1 wherein the extended waveguide cavity is abutted to the surface of the substrate waveguide and separated therefrom by a layer of cladding with apertures for transmitting pump light into the substrate waveguide.

16. The laser of claim 1 wherein the separation between the extended waveguide cavity and the substrate waveguide is such that pump light is transmitted by evanescent coupling.

17. A method for operating a waveguide laser comprising transmitting pump light from an extended waveguide laser cavity of a diode laser into a substrate waveguide laser cavity along a length of the substrate cavity, wherein the extended diode laser cavity forms part of a lower refractive index cladding of the substrate waveguide laser cavity.

18. The method of claim 17 wherein the substrate waveguide laser cavity is composed of glass doped with Er and Yb, with the diode laser and extended cavity thereof being tuned to provide pump light at a wavelength appropriate to cause lasing in the substrate waveguide cavity.

19. The method of claim 17 wherein pump light from the extended laser cavity of the diode laser is transmitted into the substrate waveguide laser cavity via evanescent coupling.

20. The method of claim 17 wherein pump light from the extended laser cavity of the diode laser is transmitted into the substrate waveguide laser cavity through apertures in a layer of cladding material interposed therebetween.

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21. The method of claim 17 wherein the substrate waveguide cavity has a reflection grating at one end for providing optical feedback to the cavity and further wherein an electro-optic polymer having a variable index of refraction is deposited on the grating to form a cladding therefor, the method further comprising tuning the laser by applying an electrical potential to the grating cladding to select a wavelength reflected by the grating that corresponds to a longitudinal mode of the substrate waveguide cavity.

22. The method of claim 17 wherein the substrate waveguide cavity has a plurality of spaced apart reflection gratings at one end for providing optical feedback to the cavity and further wherein an electro-optic polymer having a variable index of refraction is formed on the gratings to constitute claddings therefor, the method further comprising tuning the laser by selectively applying an electrical potential to the grating claddings to render one grating reflective at a wavelength that corresponds to a longitudinal mode of the substrate waveguide cavity.

23. A laser component comprising a glass substrate doped with a laser species and having one or more waveguides defined by channels within the substrate, the one or more waveguides forming one or more laser-resonator cavities with distinct resonance characteristics to provide lasing action at a selected wavelength when pumped wherein the substrate is an alkali phosphate glass doped with Er and Yb and wherein the channels are formed at a surface of the substrate as regions of increased refractive index, the laser component further comprising:

one or more feedback elements for providing optical feedback to the waveguides to form the one or more laser-resonator cavities, wherein injection of pump light at one or more suitable wavelengths into the laser-resonator cavity

causes output of laser light at a wavelength in accordance with a longitudinal cavity mode of the cavity,

wherein the laser-resonator cavities have a plurality of widths on the substrate surface to thereby define a plurality of effective indices of refraction for the cavities, the wavelength of a longitudinal cavity mode being dependent thereon and

wherein the laser-resonator cavities have a plurality of widths on the substrate surface adjacent a diffraction Bragg reflector (DBR) to thereby define a plurality of different wavelengths defined at spaced-apart wavelength intervals to match standard wavelength spacings.

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24. The laser component of claim 23 wherein the laser-resonator cavities are fabricated in a plurality of groups, wherein the cavities in each group have a plurality of widths on the substrate surface adjacent a DBR to thereby define a plurality of different wavelengths defined at spaced-apart wavelength intervals, such that one cavity per group matches a standard wavelength associated with that group.

25. The laser component of claim 23 wherein the feedback element comprises a reflection grating formed on the substrate surface along the length of the waveguide and wherein a reflection grating of a single pitch is formed on the surface of the substrate at differing angles to a plurality of waveguides to form laser-resonator cavities of differing lasing wavelengths.

26. An optical substrate for fabrication of optical devices therein comprising a block of glass having distinct regions doped with varying concentrations of one or more laser species, wherein the substrate is constructed by fusing together a plurality glass blocks having differing concentrations of the same or different dopants wherein at least one region is undoped, the substrate further comprising a optic amplifier and a waveguide for conveying pump light to the amplifier fabricated therein, wherein at least a portion of the waveguide is located in an undoped region of the substrate.

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27. An optical substrate for fabrication of optical devices therein comprising a block of glass having distinct regions doped with varying concentrations of one or more laser species, wherein the substrate is constructed by fusing together a plurality glass blocks having differing concentrations of the same or different dopants wherein at least one region is undoped, the substrate further comprising a laser resonator and a first waveguide for conveying pump light to the resonator fabricated therein, wherein at least a portion of the first waveguide is formed in an undoped region of the substrate.

28. An optical substrate for fabrication of optical devices therein comprising a block of glass having distinct regions doped with varying concentrations of one or more laser species, wherein the substrate is constructed by fusing together a plurality glass blocks having differing concentrations of the same or different dopants, further comprising a laser resonator and a laser amplifier fabricated therein, wherein the resonator and amplifier are formed in regions of the substrate with different dopant concentrations.

29. An optical substrate for fabrication of optical devices therein comprising a block of glass having distinct regions doped with varying concentrations of one or more laser species, wherein the substrate is constructed by fusing together a plurality glass blocks having differing concentrations of the same or different dopants, the substrate further comprising a plurality of laser resonators fabricated therein, wherein the resonators are formed in regions of the substrate doped with different laser species so that lasing occurs within the resonators at different wavelengths.

30. A laser comprising:

a glass substrate doped with a laser species;

a waveguide within the substrate forming a laser resonator cavity;

a reflection grating in the substrate waveguide for providing feedback to the resonator cavity;

means for tuning the laser by altering the wavelength reflected by the grating; and

means for pumping the laser by exciting the laser species of the substrate waveguide wherein the laser tuning means comprises:

a cladding deposited on the reflection grating of the substrate waveguide, the cladding being composed of an electro-optic polymer with a variable index of refraction; and

electrodes for applying an electrical potential across the grating cladding to vary the index of refraction in accordance therewith and thereby vary the wavelength of light reflected by the grating.

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31. A laser comprising:

a glass substrate doped with a laser species;

a waveguide within the substrate forming a laser resonator cavity;

a reflection grating in the substrate waveguide for providing feedback to the resonator cavity;

means for tuning the laser by altering the wavelength reflected by the grating; and

means for pumping the laser by exciting the laser species of the substrate waveguide wherein the laser tuning means comprises:

one or more additional reflection gratings formed on the substrate waveguide, each grating having a cladding composed of an electro-optic polymer with a variable index of refraction deposited thereon; and

electrodes for selectively applying an electrical potential across each grating cladding to vary the index of refraction in accordance therewith and render the grating transparent or reflective at a wavelength corresponding to a longitudinal mode of the substrate waveguide laser cavity.

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32. A laser comprising:

a glass substrate doped with a laser species;

a waveguide within the substrate forming a laser resonator cavity;

a reflection grating in the substrate waveguide for providing feedback to the resonator cavity;

means for tuning the laser by altering the wavelength reflected by the grating; and

means for pumping the laser by exciting the laser species of the substrate waveguide wherein the laser tuning means comprises:

electrodes and a resistive element for heating and thermally expanding the reflection grating of the substrate waveguide to alter the wavelength reflected by the grating.

33. A laser comprising:

a glass substrate doped with a laser species;

a waveguide within the substrate forming a laser resonator cavity;

a reflection grating in the substrate waveguide for providing feedback to the resonator cavity;

means for tuning the laser by altering the wavelength reflected by the grating; and

means for pumping the laser by exciting the laser species of the substrate waveguide wherein the laser tuning means comprises:

electrodes for applying an electrical potential to a piezo-electric layer applied to the reflection grating to thereby vary the wavelength of light reflected by the grating.

34. A laser comprising:

a glass substrate doped with a laser species;

a waveguide laser resonator cavity formed within the substrate;

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a cladding composed of an electro-optic polymer with an electrically variable index of refraction deposited on the waveguide;

electrodes for applying an electrical potential across the cladding to vary the index of refraction in accordance therewith and thereby vary the effective refractive index of the waveguide cavity; and

a pump laser for injecting pump light into the substrate waveguide cavity.

35. A method for operating a waveguide laser comprising injecting pump light into a waveguide laser resonator cavity wherein the laser cavity has a reflection grating at one end for providing optical feedback to the cavity and further wherein the grating is responsive to application of an external voltage by changing the wavelength of light reflected by the grating in accordance the applied voltage, the method further comprising tuning the laser by applying an electrical potential to the grating to select a wavelength reflected by the grating that corresponds to a longitudinal mode of the substrate waveguide cavity.

36. The method of claim 35 wherein the grating is coated with a cladding composed of an electro-optic polymer having a variable index of refraction such that application of a voltage to the cladding changes the wavelength of light reflected by the grating.

37. The method of claim 35 wherein the grating is composed of an electro-optic polymer having a variable index of refraction such that application of a voltage to the cladding changes the wavelength of light reflected by the grating.

38. The method of claim 35 wherein the grating is coated with a piezo-electric coating such that application of a voltage to the coating thereby varies the wavelength of light reflected by the grating.

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